The President

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NATIONAL SECURITY COUNCIL

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May 20, 1955

NOTE BY THE EXECUTIVE SECRETARY
to the
NATIONAL SECURITY COUNCIL
on
U. S. SCIENTIFIC SATELLITE PROGRAM

The enclosed draft statement of policy on the subject, prepared by the NSC Planning Board at the request of the Department of Defense, is transmitted herewith for consideration by the National Security Council at its meeting on May 26, 1955.

A Financial Appendix, a Technical Annex (Annex A), and a letter containing the views of Mr. Nelson A. Rockefeller, Special Assistant to the President (Annex B), are also enclosed herewith for the information of the Council.

It is recommended that, if the Council adopts the enclosed statement of policy, it be submitted to the President with the recommendation that he approve it, direct its implementation by all appropriate executive departments and agencies of the U. S. Government, under the coordination of the Secretary of Defense in consultation with the Secretary of State.

It is requested that special security precautions be observed in the handling of the enclosure, which is being given a limited distribution.

JAMES S. LAY, JR.
Executive Secretary

cc: The Secretary of the Treasury
The Director, Bureau of the Budget
The Chairman, Joint Chiefs of Staff
The Director of Central Intelligence

U. S. SCIENTIFIC SATELLITE PROGRAM

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DRAFT

STATEMENT OF POLICY

ON

U. S. SCIENTIFIC SATELLITE PROGRAM

GENERAL CONSIDERATIONS

1. The U. S. is believed to have the technical capability to establish successfully a small scientific satellite of the earth in the fairly near future. Recent studies by the Department of Defense have indicated that a small scientific satellite weighing 5 to 10 pounds can be launched into an orbit about the earth using adaptations of existing rocket components. If a decision to embark on such a program is made promptly, the U. S. will probably be able to establish and track such a satellite within the period 1957-58.

2. The report of the Technological Capabilities Panel of the President's Science Advisory Committee recommended an immediate program leading to a very small satellite in orbit around the earth, and that re-examination should be made of the principles or practices of international law with regard to "Freedom of Space" from the standpoint of recent advances in weapon technology.

3. On April 16, 1955, the Soviet Government announced that a permanent high-level, interdepartmental commission for interplanetary communications has been created in the

Astronomic Council of the USSR Academy of Sciences. A group of Russia's top scientists is now believed to be working on a satellite program. In September 1954 the Soviet Academy of Sciences announced the establishment of the Tsoilkousky Gold Medal which would be awarded every three years for outstanding work in the field of interplanetary communications.

4. Some substantial benefits may be derived from establishing small scientific satellites. By careful observation and the analysis of actual orbital decay patterns, much information will be gained about air drag at extreme altitudes and about the fine details of the shape of and the gravitational field of the earth. Such satellites promise to provide direct and continuous determination of the total ion content of the ionosphere. These significant findings will find ready application in defense communication and missile research. When large instrumented satellites are established, a number of other kinds of scientific data may be acquired. The attached Technical Annex (Annex A) contains a further enumeration of scientific benefits.

5. [redacted]

[redacted]

6. Considerable prestige and psychological benefits will accrue to the nation which first is successful in launching a satellite. The inference of such a demonstration of advanced technology and its unmistakable relationship to intercontinental ballistic missile technology might have important repercussions on the political determination of free world countries to resist Communist threats, especially if the USSR were to be the first to establish a satellite. Furthermore, a small scientific satellite will provide a test of the principle of "Freedom of Space". The implications of this principle are being studied within the Executive Branch. However, preliminary studies indicate that there is no obstacle under international law to the launching of such a satellite.

7. It should be emphasized that a satellite would constitute no active military offensive threat to any country over which it might pass. Although a large satellite might conceivably serve to launch a guided missile at a ground target, it will always be a poor choice for the purpose. A bomb could not be dropped from a satellite on a target below, because anything dropped from a satellite would simply continue alongside in the orbit.

8. The U. S. is actively collaborating in many scientific programs for the International Geophysical Year (IGY), July 1957 through December 1958. The U. S. National Committee of the IGY has requested U. S. Government support for the establishment of a scientific satellite during the Geophysical Year. The IGY affords an excellent opportunity to mesh a scientific satellite program with the cooperative world-wide geophysical observational program. The U. S. can simultaneously exploit its probable technological capability for launching a small scientific satellite to multiply and enhance the over-all benefits of the International Geophysical Year, to gain scientific prestige, [redacted] The U. S. should emphasize the peaceful purposes of the launching of such a satellite, although care must be taken as the project advances not to prejudice U. S. freedom of action (1) to proceed outside the IGY should difficulties arise in the IGY procedure, [redacted]

9. The Department of Defense believes that, if preliminary design studies and initial critical component development are initiated promptly, sufficient assurance of success in establishing a small scientific satellite during

the IGY will be obtained before the end of this calendar year to warrant a response, perhaps qualified, to an IGY request. The satellite itself and much information as to its orbit would be public information. The means of launching would be classified.

10. A program for a small scientific satellite could be developed from existing missile programs already underway within the Department of Defense. Funds of the order of $20 million are estimated to be required to give reasonable assurance that a small scientific satellite can be established during 1957-58 (See Financial Appendix).

COURSES OF ACTION

11. Initiate a program in the Department of Defense to develop the capability of launching a small scientific satellite by 1958, with the understanding that this program will not prejudice continued research [redacted] or materially delay other major Defense programs.

12. Endeavor to launch a small scientific satellite under international auspices, such as the International Geophysical Year, in order to emphasize its peaceful purposes, provided such international auspices are arranged in a manner which:

a. Preserves U.S. freedom of action in the field of satellites and related programs.

b. Does not delay or otherwise impede the U.S. satellite program and related research and development programs.

c. Protects the security of U.S. classified information regarding such matters as the means of launching a scientific satellite.

d. Does not involve actions which imply a requirement for prior consent by any nation over which the satellite might pass in its orbit, and thereby does not jeopardize the concept of "Freedom of Space".

FINANCIAL APPENDIX

1. Funds of the order of $20 million are estimated to be required to assure a small scientific satellite during the period of the IGY. This figure allows for design and production of adequate vehicles and for scientific instrumentation and observation costs. It also includes preliminary back-up studies of an alternate system without vehicle procurement. The ultimate cost of a scientific satellite program will be conditioned by (1) size and complexity of the satellite, (2) longevity of each satellite, and (3) duration of the scientific observation program. Experience has shown that preliminary budget estimates on new major experimental and design programs may not anticipate many important developmental difficulties, and may therefore be considerably less than final costs.

2. The estimate of funds required is based on:

satellite vehicle	$10-$15 million
instrumentation for tracking	$2.5 million
logistics for launching and tracking	$2.5 million
TOTAL	$15-$20 million

3. These estimates do not include funding for military research and development already part of other missile programs. They include costs for observations that might properly be undertaken by Department of Defense agencies as part of the Department of Defense mission. They do not include costs of other observations that may be proposed by other agencies. They will provide a minimum satellite for which two vehicle systems now under study offer good promise, "Orbiter" and "Viking". They also include exploratory studies for a back-up program based upon the "Atlas" missile and "Aerobee" research rocket development.

ANNEX A

TECHNICAL ANNEX

Scientific Values

1. The scientific information that may be expected from a satellite is dependent upon the size of the vehicle and whether it can be instrumented.

2. From a small, inert, trackable satellite, it is reasonable to expect that the following scientific values may be derived:

a. Analysis of currently available information on the upper atmosphere shows a need for additional basic information to support the development of manned craft and missiles for use at high altitudes. More accurate data on air density, pressure and temperature are required. From the analysis of actual orbital "decay" patterns, the air drag at high altitudes can be determined to a greater accuracy than by techniques now available.

b. Electronic tracking would probably permit direct and continuous determination of the total ion content of the ionosphere by comparison of simultaneous electronic and visual observations.

c. Anti-missile missile research will be aided by the experience gained in finding and tracking artificial satellites. It is expected that the satellite will approximate the speed and altitude of an intercontinental ballistic missile.

d. It is probable that a small scientific satellite would yield measurements of high geodetic value. More precise determinations of relative position between continents, the value of the gravitational constant averaged over long distances, and the earth's semimajor axis can probably be made by observations of a small scientific satellite.

e. The observation of an uninstrumented satellite in an orbital plane inclined to the equator can permit the determination of the rotation of the orbital plane in space about the earth's polar axis, commonly called the "regression of the nodes". This perturbation is caused by the oblateness of the earth. Its evaluation will have considerable significance in precisely forecasting satellite orbits.

Military Values

3. In addition to the scientific values listed above, some of which are clearly relevant to missile and anti-missile research and development programs of the Department of Defense, it may be noted that military communications programs will be enhanced by improvements in knowledge of the ionosphere and by improved knowledge of the rate of earth rotation. To this list must also be added the direct values of experience in organization, operation and logistics accruing to military missile forces detailed to execute a scientific satellite firing program. It is expected that the satellite will approximate the speed and altitude of an intercontinental ballistic missile.

Orbit and Tracking Considerations

4. If a perigee approximating 200 miles and an apogee approximately 1,000 miles are used to fix the desired orbit, the satellite will pass completely around the earth in approximately 90 minutes. If an orbit over the earth's poles or an orbit inclined to the equator is selected, the satellite will pass successively farther west of the launching point on each revolution around the earth. This means that an individual tracking station set up for inclined orbits will not be in an observing position for every revolution. The optimum location for tracking polar orbits is at or near the poles. On the other hand, an equatorial orbit will place each observing station in position to observe every circuit of the satellite. Artificial satellites in a low roughly circular orbit will appear optically similar to a 5.6 magnitude star moving at a high angular rate. Optical observations in broad daylight will be impracticable and observations when the satellite is in the earth's shadow will also be impracticable unless the satellite is illuminated. This means that experiments depending on passive optical tracking of a satellite cannot be conducted except during 50 minutes at dawn and 50 minutes at dusk. An inclined orbit would thus materially reduce the usable data per station for experiments based on passive optical observations. The usefulness of the satellite and the selection of the desirable orbit is, therefore, closely related to the degree to which the satellite can be acquired and tracked by electronic techniques as well as optical.

5. An inclined orbit utilizing Patrick Air Force Base at Cocoa, Florida, as a launching point has the following advantages over an equatorial orbit:

a. Eliminates necessity to mount tropical expedition to establish launching and tracking sites.

b. Permits observation from Navy Air Missile Test Center, Point Mugu, California; Naval Ordnance Test Station, Inyokern, California; White Sands Proving Ground, New Mexico; British-Australian Guided Missile Range, Woomera, Australia; and a large number of the free world's astronomical observatories.

c. Utilizes the full length (5000 miles) of Long Range Proving Ground for observations of the critical first part of the first orbit.

d. Permits an accumulation of geophysical data over a larger area of the earth's surface.

6. Disadvantages of an inclined orbit when compared to an equatorial orbit are:

a. Inclined orbit provides fewer opportunities to observe from a single base. This is especially critical for small uninstrumented satellites not observable by ordinary radar.

b. Inclined orbit from Patrick Air Force Base reaching a maximum latitude of 35° would result in the satellite passing on different circuits over virtually all of the world between 35°N latitude and 35°S latitude. This might increase substantially the amount of diplomatic negotiations necessary to implement the program.

Hazards to Human Life

7. The launching of a scientific satellite does not appear to threaten in any serious way the safety of air transportation at normal altitudes, nor the safety of personnel and property on the ground. All of the scientific satellites discussed above would be launched from locations where the initial flight of the booster system would be over water. At the end of this stage the booster rocket, which is the largest and potentially most lethal part of the satellite, would separate and fall into the water. Normal precautions taken in launching ordinary guided missiles would suffice to assure adequate safety of the launch and booster phases. The orbiting vehicle in all cases of both instrumented and uninstrumented satellites would be designed with the objective in mind that the entire device would disintegrate and to a large extent vaporize under the heat of re-entry into the earth's atmosphere. This vehicle would, therefore, create negligible hazards after re-entering the atmosphere.

THE WHITE HOUSE

Washington

COPY May 17, 1955

MEMORANDUM FOR MR. JAMES S. LAY, JR.
Executive Secretary
National Security Council

Subject: U. S. Scientific Satellite Program

1. I should like to register my enthusiastic support of the proposal of the Department of Defense (RD-CGS 202/4) which you sent to me under cover of your memorandum of May 13, 1955.

2. I am impressed by the psychological as well as by the ..... advantages of having the first successful endeavor in this field result from the initiative of the United States, and by the costly consequences of allowing the Russian initiative to outrun ours through an achievement that will symbolize scientific and technological advancement to peoples everywhere. The stake of prestige that is involved makes this a race that we cannot afford to lose.

3. Because of the basically new questions of ionosphere jurisdiction that are involved, and because the announced Soviet program in interplanetary communications makes it certain that a vigorous propaganda will be employed to exploit all possible derogatory implications of any American success that may be achieved, it is highly important that the U. S. effort be initiated under auspices that are least vulnerable to effective criticism. The extraordinary opportunities for exploitation of superstitions on the one hand and of imputed military hazards on the other that are inherent in a scientific "breakthrough" of such novelty make it imperative to enlist many voices speaking for numbers of nations to allay the potentially boundless fears that may be stirred up, even though they are quite unwarranted.

I agree, therefore, with the suggested procedure of having our Government announce that it is ready to support the project through the U.S. National Committee of the International Geophysical Year. It is important for the following reasons that the U.S. proposal be made public at the time when it is submitted to the IGY:

A. The International Geophysical Year was established by the International Union of Scientific Societies which in turn is affiliated with UNESCO - part of the United Nations structure.

B. I am informed that the IGY in its Rome meeting last year endorsed the launching of a satellite as a desirable scientific step.

C. Since Russia is represented in this organization it would be in a position to know immediately of any U.S. offer made by the Government through the U.S. National Committee to launch a satellite.

D. If the U.S. offer was not made public the Soviet might take immediate action and do one of two things:

1) Announce it has already launched a satellite.
2) Make an offer to launch one themselves.

thus reducing the psychological significance and prestige values of the U.S. proposal.

4. The announcement of the U.S. offer might be made by Ambassador Lodge to the United Nations. Although the IGY is affiliated with the United Nations, for public reassurance the Ambassador might state that the United States would welcome some form of direct U.N. sponsorship for the project since its intent was to contribute to the world body of scientific knowledge through study of the satellite in flight. Needless to say, the offer of sharing knowledge would not be extended to the method of launching.

5. The fact that Russia was represented upon the International Geophysical Year which endorsed a satellite launching project can be used to good effect by us in the event that there should be a concerted Communist effort to brand the project as evil or threatening. We should, alternatively, be ready to meet a Soviet statement that it, too, is preparing to launch a satellite upon a shorter time-table or even, at some date, an announcement, true or false, that it has launched one.

c. Since a U.S. success in being the first to launch a small uninstrumented satellite could be quickly discounted if the Soviets were to follow it with an initial success in the launching of a satellite of more sophisticated type, I believe that the exploratory work on the latter type recommended in paragraph II C of the Department of Defense memorandum should be pursued vigorously in the United States concurrently with the program recommended for immediate implementation.

s/ N A R

Nelson A. Rockefeller
Special Assistant